

## **A Study on Character Recognition System Using Neural Network**

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### **ABSTRACT:**

*Character recognition system is today's one of the most demanding applications of ingenious technologies. Classification based on alphabets, numerals, special characters are the basis of various recognition systems. Artificial neural network when merged with this recognition paradigm, the system obtained is of optimum performance with minimum error. These networks constitute several neurons which are focussed at single goal which is set by the designer. This paper deals with the run through of the whole recognition system design and the various stages involved in it and neural network learning methodology.*

**KEYWORDS:** Character recognition, artificial neural network, optimum, minimum error, learning.

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### **I. INTRODUCTION**

Most prominent application of an artificial neural network is in the field of pattern recognition. Out of this character recognition system is designed using these networks is more advantageous because they are highly noise tolerant. Character recognition system is similar to the human beings ability of reading, using artificial means. This system enables the user to convert scanned documents, images and pdfs into an editable and searchable data. Recognition of both printed and handwritten characters is a typical domain where neural networks have been successfully applied. Optical character recognition systems were among the first commercial applications of neural network. This is the process of automatic recognition of different characters from a documented image. It also provides a full alphanumeric recognition of handwritten or printed characters, texts, numerals, letters into a computer process able format such as ASCII. This system is largely motivated so as to build up a strong man machine communication. There are two types character recognition system –Offline and Online. In offline recognition system, the source is either an image or a scanned document. In online recognition system, the successive points are represented as a function of time and the order of strokes are also available. Artificial neural network is a machine learning approach that models human brain and consists of a number of artificial neurons. Neurons in ANN tend to have fewer connections than biological neurons. Each neuron receives a number of inputs and an activation function is applied to these inputs which results in activation level of neurons.

There are three types of learning paradigms in artificial neural networks- supervised learning, unsupervised learning and reinforcement learning. Supervised learning includes training sets behaviour and pattern of output is according to the goal desired. It also includes both classification and regression. The unsupervised learning includes the ability of finding pattern in a stream of inputs. The network finds the desired goal and keeps computing till final desired result is obtained.

Reinforcement learning is a type in which an agent is rewarded for good response and punished for bad ones.

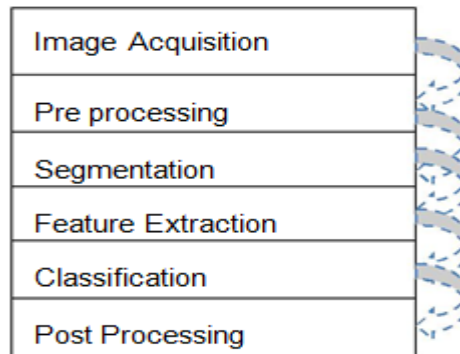
### **II. TOOLS OF ARTIFICIAL INTELLIGENCE**

There are mainly seven tools of artificial intelligence. They are search and optimisation technique which includes planning. Second tool is probabilistic methods for uncertain reasoning which includes Bayesian network, Hidden Markov Model, Kalman Filter, Decision and utility theory. Third one is classifiers and statistical learning. Neural network, control theory and last is the languages like IPL, LISP, Prolog, STRIPS, POP-11, Haskel, MATLAB and Lush.

### **III. PROBLEM STATEMENT**

Recognition of English characters is a process in which an English character image is loaded and preprocessing is done. Feature extractions is done thereafter and the classification is done on the basis of similarity of parameters between the loaded image and the image models. The neural network learning rate is also determined. The trained image and test image must be of same file extension and preferably of same size. MATLAB's image processing toolbox and neural network toolbox can be used for simulation.

Figure1: Processes involved in character recognition system.



#### IV. METHODOLOGY OF CHARACTER RECOGNITION SYSTEM

The figure above shows the main components of character recognition system which broadly comprises of image acquisition, pre processing of image , segmentation of image, feature extraction from image, classification and post processing.

Feature extraction is the main and peculiar step in this. This is the base from which two images can be classified and categorised as to whether two images are similar or dissimilar.

##### 4.1 Image Acquisition

In case of hand written characters ,the image is taken and scanned so that the image can be made available for soft computing.

##### 4.2 Pre processing of image

The image is first being converted to gray scale and thresholding is done and makes the image a binary image .Edge detection is done on the binary image and then image dilation and image filling is done. After obtaining the edges ,the edges are dilated so as to obtain smooth edge. Blob analysis is done to get the properties of the dilated image. Character is extracted and then it is moved to feature extraction step.

##### 4.3 Feature extraction

After obtaining the character ,image skeletonisation is done. Since skeleton of each character is an unique attribute which allows classification process. **Skeletonisation** is a unique geometrical description that requires very less pixels than the original image. **Chain codes** are used to represent boundary of connected sequence of either 4 or 8 straight lines.This chain code works best for binary images and gives shape contour. 1-D Fourier Transform can also be done for finding the contour of an object. Euler number is also one method of finding the number of connected regions an image has.

##### 4.4 Classification Of images

MATLAB function 'isequal(I1,I2)' can be used to test the two images parameters and skeletons.

##### 4.5 Neural Network Training

Neural network training is done using Levenberg –Marquardt. The following figures show the entire process of image acquisition and training the neural network.

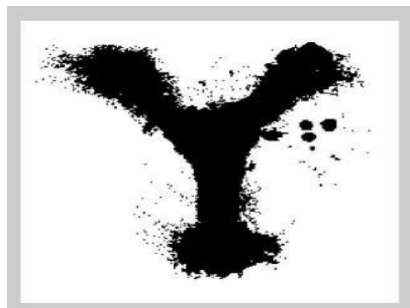


Figure2: jpg image of alphabet y.

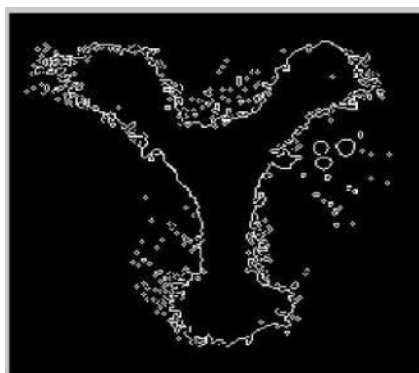


Figure3: Binary image of input image.

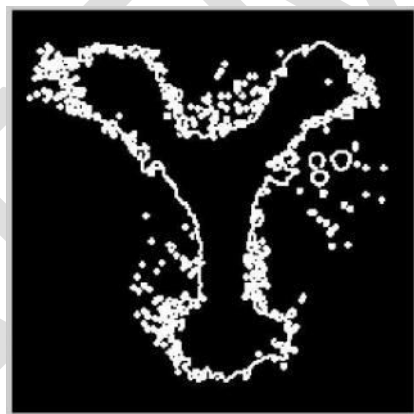


Figure4: Edge detection on binary image.



Figure5: Dilated image of edged alphabet.

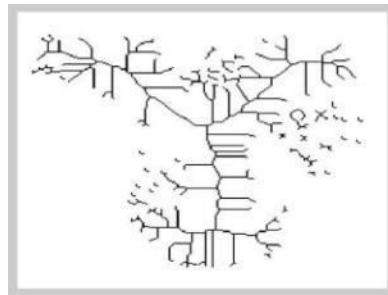


Figure6: skeleton of alphabet y.

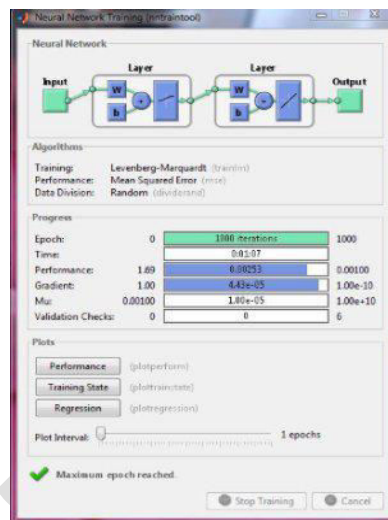


Figure7: Neural network training.

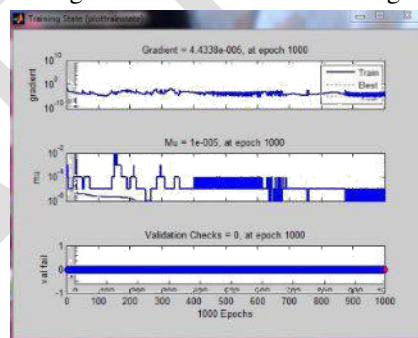
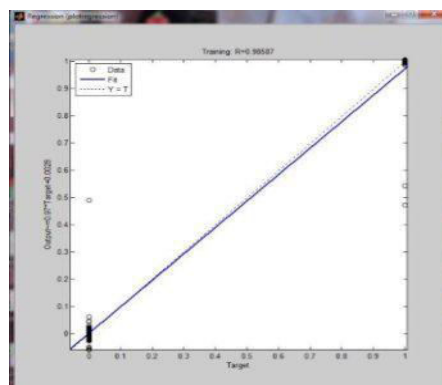


Figure8: Graph between mean squared error and maximum epoch

Figure9: training graph.



## **V. NEURAL NETWORK TRAINING ALGORITHMS FOR CHARACTER RECOGNITION SYSTEM**

Artificial neural network Back Propagation algorithm is used in many researches. Gradient Descent, Levenberg Marquardt, classifiers like K-NN can also be applied. It depends on the user whether supervised learning or unsupervised learning algorithms is required in the system. Speeded Up Robust Features method, Peak signal to noise ratio method, Most similar neighbour are methods been applied in this context.

## **VI. CONCLUSION**

Character recognition system is a big challenge in real time application as its performance is dependent on the quality of input document. On the occurrence of some noise signal in image post processing is also required thereafter. There are many other methods of feature extraction still being researched and consequently the learning rate altered is studied.

## **VII. ACKNOWLEDGEMENT**

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